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MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF CORNELL UNIVERSITY

Communicated by E. B. TITCHENER and H. P. WELD

XXXII. ON CUTANEOUS AFTER-IMAGES

By F. L. DIMMICK

In 1897 F. H. Spindler published the results of experiments on "after-sensations of touch."¹ The irregularity of these results led us, in the following year, to repeat and extend the experiments. The experimenter was Mr. J. H. Wilson, a senior in psychology; the observers were Drs. T. L. Smith and G. M. Whipple, and Messrs. H. O. Cook, W. B. Secor, and W. H. Standing, seniors in the department. Eight weights, of 50 to 1000 gr., were applied to the skin for 5, 10 and 15 sec. Our results were in substantial agreement with those of Spindler. We found evidence, however, both objective and subjective, that the principal cause of irregularity (aside from crudeness of technique) was the response of *two* sensitive tissues (skin and underlying muscle) to the stimuli employed. *Two* after-sensations of different course and quality seem to be intermingled in this "after-sensation of touch"; and neither Spindler's original method nor the improved form of it used by Wilson enables us accurately to distinguish the two components. It has, accordingly, not seemed worth while to publish Wilson's results in detail.

Meantime M. H. S. Hayes has made a much more thorough study of the after-sensations from cutaneous stimulation.² As a stimulus for "punctiform" pressure, she used "rounded wooden points 1/32 inch in diameter, and von Frey hairs. These were applied, in the usual way, upon pressure spots which had been located and marked several days previous." Whether the intensity of the stimulus employed was above the limen for subcutaneous pressure does not seem to have been considered. For this reason we have repeated the work upon isolated pressure spots, using a stimulus whose intensity is known to be below the limen for subcutaneous pressure. This stimulus was the hair of a von Frey hair-aesthesiometer (length, 39 mm.; diameter, 0.18 mm.; force, 0.405 g.; tension value, 4.5 gr./mm.). The skin of the fore-arm was lightly anaesthetized; and it was found that, although the stimulus was well above the limen for the normal skin, no sensation was aroused during the anaesthesia. The aesthesiometer was applied by means of a mechanical device, which we hoped would ensure constancy and accurate timing of the stimulation. The essential parts of this device consisted of a wooden plunger working in a brass cylinder. From the side of the plunger extended a horizontal arm, which worked vertically in a slot in the cylinder. The arm carried a clamp in which the aesthesiometer was held. The apparatus was so supported over the arm of the observer that it could be moved in both directions in the horizontal. An electrical circuit was made at the instant the stimulus was applied and broken when it was removed. The observer reacted

¹ Psych. Rev., iv., 631ff.

² Psy. Rev. Mon. Sup. 60, 1912.

by pressing a key; and both records were written alongside of a 10 per sec. time line.

Method.—The observer was comfortably seated, with his right arm extended and resting upon a felt cushion. At his left hand was the reaction-key. He was told that his arm would be stimulated by a hair, and was instructed to hold down the key so long as he felt anything at the place of stimulation. The record showed the length of time during which the stimulus was applied, the point at which the observer felt the stimulus, the point at which he ceased to feel it, the point of arousal of the after-image (if there were an after-image), and its duration. After every stimulation the observer gave a brief introspective report of his experience. Ten pressure spots on the forearm of each observer were stimulated. These were marked by clipping away all the hairs in the region of stimulation except those at the bases of which the chosen spots lay. Only one intensity of stimulus was used. The time of stimulation was approximately 1 sec. Two observers took part in the experiments: G. J. Rich (R), and R. H. Cobb (C), both graduate students in psychology. About twenty series were taken with R, and fifteen with C.

Sources of Error.—(1) The times of stimulation were taken by a stop watch, and were not absolutely constant. A record of the exact times was kept, and the variation was found to be in the neighborhood of 12%. (2) Although every pressure spot was localized within an area of less than 1 mm., it was impossible to be certain that stimulation within that area would always produce the same impression. This uncertainty is borne out by the introspections. (3) Adaptation of the pressure spots was avoided by stimulating each one only once at a sitting.

Results.—The quantitative results for the two observers are given in the following tables.

TABLE I
OBSERVER C—69 CASES

Spot	Total Response A.Sn. + Int. + A.Im.	M.V. of A.Sn.	Int. + A.Im.	M.V. of Int.	A.Im.	M.V. of A.Im.	Report of Observer	
							Tickle	Pressure (No Report)
1	10.88	(1.56)	8.61	(0.76)	7.66	(3.55)	5	2
5	9.92	(2.36)	6.55	(1.24)	5.26	(1.47)	2	3
6	9.54	(0.69)	8.53	(0.74)	7.37	(2.99)	5	2
4	8.72	(0.54)	7.48	(0.51)	6.75	(1.98)	3	4 (1)
8	8.68	(0.70)	7.10	(0.48)	6.48	(1.24)	6	3
2	8.54	(0.57)	7.31	(0.35)	6.58	(2.15)	3	2 (2)
3	7.17	(0.49)	6.27	(0.89)	5.37	(2.14)	2	6 (1)
7	7.06	(0.18)	6.43	(0.05)	6.22	(1.74)	0	5
10	6.72	(0.2)	5.94	(0.49)	5.30	(1.68)	0	4 (1)
9	6.48	(0.56)	5.10	(0.4)	4.50	(1.34)	2	4 (1)
	Av.		Av.		Av.			
Summary	A.Sn.	M.V.	Int.	M.V.	A.Im.	M.V.	28	35 (6)
	1.44	(0.15)	0.78	(0.57)	6.15	(2.18)		

TABLE II
OBSERVER R—71 CASES

(I) 53 Cases

Spot	Total Response A.Sn. + Int. + A.Im.	M.V. of A.Sn.	Int. + A.Im.	M.V. of Int.	A.Im.	M.V. of A.Im.	Report of Observer	
							Tickle	Pressure
6	87.34	(12.62)	70.99	(1.8)	62.64	(13.3)	1	3
2	81.45	(13.72)	58.00	(2.91)	50.50	(8.0)	1	3
7	73.76	(11.03)	62.75	(3.4)	56.49	(11.9)	0	9
10	68.83	(18.64)	47.80	(4.2)	38.50	(16.7)	1	2
4	65.70	(0.47)	63.90	(2.9)	60.30	(22.7)	0	3
3	59.56	(1.14)	55.79	(3.7)	47.56	(25.4)	0	6
9	50.97	(9.7)	46.56	(3.6)	39.34	(18.9)	1	9
1	42.95	(3.79)	38.63	(2.91)	34.72	(19.9)	4	1
5	39.08	(2.7)	33.68	(1.67)	30.40	(20.2)	2	1
8	38.34	(14.0)	27.33	(5.6)	21.63	(10.3)	1	5
Summary..	Av. A.Sn.	M.V. (10.45)	Av. Int.	M.V. (3.7)	Av. A.Im.	M.V. (19.44)	11	42

II. 18 Cases

Spot	A.Sn.	M.V.					T	P
5	97.6	(31.1)	.....	.....	.....	.....	1	1
6	86.9	(38.5)	.....	.....	.....	.....	0	3
9	84.8	(0 )	.....	.....	.....	.....	0	1
4	65.9	(35.2)	.....	.....	.....	.....	2	2
2	65.7	(19.5)	.....	.....	.....	.....	1	3
1	58.7	(0 )	.....	.....	.....	.....	1	0
8	43.5	(23.2)	.....	.....	.....	.....	0	2
7	20.6	(0 )	.....	.....	.....	.....	0	1
Summary..	66.7	(28.32)	.....	.....	.....	.....	5	13

That the After-Image is the most important of the moments is evident from the fact that the order of magnitude of the After-Image follows almost exactly that of the Total Response. There are only two bad inversions for R (spots 2 and 4), and one for C (spot 5), and these occur where there is an especially high M. V. for After-Sensation or Interval or both. The orders of magnitude of the other two moments do not follow that of the Total Response.

Observer R reported pressure in a large percentage of cases and tickle in comparatively few, whereas C reported tickle in nearly half of his observations.

The times for R are very much longer than those for C. The ratios between the three moments, however, are very nearly the same for both observers; and the times of all three moments for R are nearly 8 times as long as those for C. These ratios are given in the following tables.

TABLE III

Ratios	Obs. C.	Obs. R.
Latent interval	0.528	0.587
After-sensation		
After-image	4.27	3.89
After-sensation		
After-image	7.884	6.625
Latent interval		

TABLE IV

Ratio	After-sensation	Latent Interval	After-image
Obs. R.	7.9	8.5	7.2
Obs. C.			

Conclusions.—The results we have obtained seem to agree roughly with those of Hayes, though her findings are not given in a form that permits of direct comparison. Our results show the same wide variation for each observer and between observers; and the ranges of variation are approximately the same. We found the after-sensation always present. After-images were reported in a much larger number of cases than by Hayes. This difference may be due to the difference in the stimulus employed. Whether the relation which we have found between our two observers appeared in Hayes' work it is impossible to tell, but her "quantitative individual tables" indicate that an observer's times were either all long or all short.

XXXIII. ON PERCEPTIVE FORMS BELOW THE LEVEL OF THE TWO-POINT LIMEN

By E. DE LASKI

It is clear from the results obtained by Gates¹ and Titchener² that certain of the perceptive patterns which occur below the level of the cutaneous two-point limen are sufficiently stable for quantitative determination. It seems desirable that the whole range of these patterns³ be systematically explored, and the present paper records a first beginning of such exploration.

¹ E. J. Gates, The Determination of the Limens of Single and Dual Impression by the Method of Constant Stimuli, this JOURNAL, xxvi, 1915, 152ff.

² E. B. Titchener, in *Proc. Amer. Philos. Soc.*, lv, 1916, 208ff.

³ For the patterns in general see M. Foucault, *L'illusion paradoxale et le seuil de Weber*, 1910, 124f.